MAHANADI

Community Voice on Inter State River Water
Chhattisgarh & Odisha

actionaid

Report published in 2018

Published by
Natural Resource Knowledge Activist Hub –A
Knowledge Initiative of Action Aid India
& Bhubaneswar Regional Office, Odisha
331/A, Shahid Nagar, Bhubaneshwar -751007
Phone – 06742548224/2548503

Design & Printing by
Baba Printer
Bhubaneswar

Acknowledgement

We are highly thankful to all those who have contributed to complete this study. The members of the people's organisations deserve special thanks individually and collectively for their time, energy and input they have given throughout the study. These organisations are Adim Adhibasi Ekata Manch, Madhapur, Adim Adhibasi Mukti Manch, Gania, Nayagarh Boudh Lokamukti Sangathan, Jharsuguda, Sambalpur, Chasi Surakshya Abhiyan, Odisha, Chasi Surakshya Manch, Athamallick-Kishannagar, Angul, Chetanashil Nagarik Manch, Jharsuguda, Gramin Shramajibi Chetana Sangathan, Gania, Mahanadi Seva Sangathan, Subarnapur, Mahanadi Surakshya Samiti, Nayagarh, Mukti, Narsinghpur, Cuttack, Nadi Adhikar Abhiyan, Odisha Ganatantrik Samukhya (OGS), Patang, Sambalpur , Rashtriya Yuva Sangathan, Odisha and Utkal Gandhi Smaraki Nidhi, Cuttack.

Our sincere thanks goes to Binapani Mishra, Secretary, SWAD, Sudarshan Chhotoray, Director, Focus Odisha, Anant, Jharsuguda, Ganesh Kachhwah & Basudev Sharma (Chhatisgarh) for unconditional support and contribution to this study. We appreciate their commitment and involvement to this issue.

We acknowledge our thanks to Priyabrata Satapathy, B N Durga and Biren Nayak for their immense contribution to this study from beginning to end.

Our special thanks to Bimal Prasad Pandia for his intellectual input and contribution to this study and report preparation.

We are thankful to Sandeep Chachra, Executive Director, Actionaid for his guidance, support and encouragement to take up this study and link it with other similar river issues in the country.

Debabrata Patra
Regional Manager
Bhubaneswar Regional Office
Actionaid Association

Bratindi Jena
Head of Natural Resource Hub
Actionaid Association

Contents

CHAPTER - I

Introduction

Rivers play an important role in the lives of Indian people. The river systems provide irrigation, potable water, easy transportation, electricity, as well as livelihoods support to a large number of people all over the country. Hence, all major cities of India are located on the banks of river. Rivers also play crucial role in cultural and spiritual life of people apart from material gains.

Rivers are parts of integrated systems that include flood plains and riparian corridors. Collectively these systems provide a large option of benefits. Dr. Kalyan Rudra emphasised that the river systems along with issues of ecology, culture, livelihood, resource sharing, river bank erosion and floods have to be taken into consideration. All these issues should be seamlessly woven or inter-linked. Any study about a river would be incomplete otherwise.[1]

Eight major Rivers, Ganga, Indus, Brahmaputra, Narmada, Tapi, Godavari, Krishna and Mahanadi along with their numerous tributaries form the river system in India. Rivers flow either in Eastern or Western direction, meeting the Arabian Sea or Bay of Bengal. Parts of Ladakh, northern parts of the Aravalli range and the arid parts of the Thar Desert have inland drainage. All major rivers of India originate from one of the three main watersheds - The Himalaya and the Karakoram ranges, Vindhya and Satpura ranges and Chotanagpur plateau and Sahyadri or Western Ghats, broadly categorised as Himalayan and Peninsular rivers. Himalayan rivers like Ganga, Indus and Brahmaputra have large basins fed by melting snow and rainfall, creating huge plains. Peninsular rivers like Narmada, Krishna, Kaveri and Mahanadi flow through shallow valleys. Large numbers of them are rain fed and seasonal.[2]

River is a gift of nature, not just flowing water. Hence there are number of views on, free flow, environmental flow, ecological and economic flow of river. River has many other functions, not only flowing water, carrying huge stones, sand formation, land creation - char, increasing fertility of land, irrigation to cultivable land, maintain river bed water sources – chuan, maintains soil moisture, nurtures and contributes in the form of tributaries.

Civilizations tended to grow up in river valleys for a number of reasons. The most obvious is access to a usually reliable source of water for agriculture and human needs. Plentiful water and enrichment of the soil due to annual floods, made it possible to grow excess crops beyond what was needed to sustain an agricultural village. This allowed for some members of the community to engage in non-agricultural activities such as construction of buildings and cities (the root of the word "civilization"), metal working, trade, and social organization.[3][4] Boats on the river provided an easy and efficient way to transport people and goods, allowing for the development of trade and facilitating central control of outlying areas.[5]

Human demands on the World's available freshwater supplies continue to grow as the global population increases. In the endeavour

[1]Ecosystems for Life, IUCN, January 2014, http://mcrg.ac.in/IUCN/IUCN_Report_Kolkata.pdf
[2]http://nihroorkee.gov.in/rbis/India_Information/rivers.htm
[3]https://en.wikipedia.org/wiki/River_valley_civilisations#cite_note-3
[4]Mountjoy, Shane (2005)Rivers in World History: The Indus River. Chelsea House Publishers.p.15.
[5]Indus River Valley Civilization". The River Valley Civilization Guide. Retrieved 27 September 2017

to manage water to meet human needs, the needs of freshwater species and ecosystems have largely been neglected, and the ecological consequences have been tragic. Healthy freshwater ecosystems provide a wealth of goods and services for society, but appropriation of freshwater flows must be better managed if hope to sustain these benefits and freshwater biodiversity. A framework for developing an ecologically sustainable water management program, in which human needs for water are met by storing and diverting water in a manner that can sustain or restore the ecological integrity of affected river ecosystems, is being researched. Six-step process in this direction may include: (1) developing initial numerical estimates of key aspects of river flow necessary to sustain native species and natural ecosystem functions; (2) accounting for human uses of water, both current and future, through development of a technical hydrologic simulation model that facilitates examination of human-induced alterations to river flow regimes; (3) assessing incompatibilities between human and ecosystem needs with particular attention to their spatial and temporal character; (4) collaboratively searching for solutions to resolve incompatibilities; (5) conducting water management experiments to resolve critical uncertainties that frustrate efforts to integrate human and ecosystem needs; and (6) designing and implementing an adaptive management program to facilitate ecologically sustainable water management for the long term. Drawing from case studies around the World to illustrate it is suggested that ecologically sustainable water management is attainable in the vast majority of the World's river basins. However, this quest will become far less feasible if one waits until water supplies are further over-appropriated. [6]

However, rivers by and large suffer from two major human made disasters - first construction of dams, barrages to store water and curtail free flow of river and secondly dump all kinds of pollutants, waste in the river assuming that it will flow in due course of time.

There is history of dams and their role in establishing industrial supremacy of societies. In this process the powerful state and corporate lobby makes a futile effort of rehabilitation and resettlement of displaced communities due to dams. The modern developmental model, based on the vision of human progress through control of nature, is fundamentally flawed. Dams driven displacement of communities especially of tribal people are evident in many parts of the country. Apart dams cause unprecedented floods while controlling inflow of excess water in the river. That leaves large areas inundated and causes massive disasters resulting loss of life and property. While during lean season river dries up in large patches, in many river post rains within a month or so river ceases to flow with adequate water.

Both industrialisation and urbanisation has contributed to creation of pollutants of all types, solid, liquid and some of these are extremely dangerous to all forms of living being. Often people find it easy to use river as untreated garbage dump. This is causing ailments not only to human beings and livestock but also killing large number of aquatics.

Rivers are dying in most parts of country. Pollution and barraging of rivers have been the major issue. Incessant flow that kept the river clean while facilitating all other functions river front blocking water are now blocked through barrages and dams. This has led to severe pollution of rivers as large numbers of pollutants are dumped in the river. Major River like Ganga, Yamuna, Brahmaputra, Kosi, Jhelum, Bagmati, Mahanadi are dammed. Both

[6] Brian D. Richter, Ruth Mathews, David L. Harrison , Robert Wigington, ECOLOGICALLY SUSTAINABLE WATER MANAGEMENT: MANAGING RIVER FLOWS FOR ECOLOGICAL INTEGRITY, First published: 01 February 2003

pollution and restrained flow of river are killing the river. Many rivers assumed to be living are also in death bed in many parts. Though rivers do not exist in parts rather is cutting across different state boundaries.[7]

This way right of river to flow free and to be free from pollution is violated. Also right to river of all living beings is denied. This is alarming not only for the present society but also for the future generation. In many part of the country river dependent communities are already feeling the burden of such development process.

Rivers in India has been revered from time immemorial as Goddesses and living beings. In different parts of the country they are worshiped on different occasions and become the centre of pilgrimage for lakhs of people both from India and abroad. Now after rampant human intervention with rivers and their flow, again the debate of restoring status of living being to rivers have emerged.

In 2017, World community witnessed, four rivers getting legal status. The Whanganui River in New Zealand, the Ganga and Yamuna Rivers in India and the Rio Atrato, in Colombia. These developments have fundamentally altered the legal status of rivers questioning about whether such approach can be transferred and generalised to other rivers across the World, including rivers in Australia. Giving nature legal rights means the law can see "nature" as a legal person, thus creating rights that can then be enforced. Legal rights focus on the idea of legal standing which enables "nature" to go to court to protect its rights. Legal personhood also includes the right to enter and enforce contracts, and the ability to hold property.[8]

After 140 years of negotiation, Māori tribe wins recognition for Whanganui (nui) river, as a living entity through the Te Awa Tupua (Whanganui River Claims Settlement) Act 2017. The new legislation integrates the river's legal status into existing legislation and provides funding and ongoing central government support for implementing and operationalising the new legal rights. The new law now honoured and reflected Māori worldview and could set a precedent for others in New Zealand to follow in Whanganui's footsteps.[9]

On March 20, 2017, Uttarakhand High Court gave recognition to the "legal status as a living person/legal entity to Rivers Ganga and Yamuna". The Court held that Ganga and all her tributaries, streams, every natural water flowing with flow continuously or intermittently of these rivers, are declared as juristic/legal persons/living entities having the status of a legal person with all corresponding rights, duties and liabilities of a living person in order to preserve and conserve the rivers of Ganga basin. Supreme Court has stayed the judgment of the High Court on July 7, 2017. The order came upon hearing the Special Leave Petition of State of Uttarakhand against the verdict. The one sentence order reads: "In the meantime, the operation of the impugned order shall remain stayed."[10] The Bench of 44th Chief Justice of India Jagdish Singh Khehar and Justice D Y Chandrachud heard the petitioner's counsel in the absence of the counsel for the respondents mentioned as 'caveator-in-person'.

River knows no boundaries. However, human created boundaries of states divide rivers between states in many parts from the origin till reaching the sea or other major river. This also has led to exercise claim over that part of the river as state property and control water sharing, downstream. This is not only happening with Transboundary Rivers sharing international border but also between states in India. Age old Cauvery river water dispute between Karnataka, Tamil Nadu and Kerala is well known. Now more rivers are entering in to such interstate river water sharing dispute and Mahanadi is one such that flows between

[7] Iyer, R. (2015) Living Rivers, Dying rivers, Oxford University Press
[8] Dr. Erin O'Donnell, (2017) New legal rights for rivers, University of Melbourne, Australia
[9] Roy, Eleanor Ainge (2017), New Zealand river granted same legal rights as human being, The Guardian
[10] (2017), Order of Supreme Court, Special Leave Petition No. 16879/2017, 7 July

Chhattisgarh and Odisha.

Mahanadi River – One of the largest basins of India

The geographical extent of the basin lies between 80028' and 86043' east longitudes and 19008' and 23032' north latitudes. It is bounded by the Central India hills on the north, by the Eastern Ghats on the south and east and by Maikala range on the west. The Mahanadi basin extends over states of Chhattisgarh and Odisha draining an area of 1,41,589 Km^2 (India-WRIS, 2018).

There is some confusion on exact area of Mahanadi basin as different sources have given varying figures of the basin area. While in its section on Mahanadi, Water Resource Information System of India (WRIS) informs that the basin area is 1,41,589 Km^2, at another place where it has given information on major river basins of India, it has informed that the total basin area of Mahanadi is 1,39,659 Km2. Some other government sources have given different figure of Mahanadi's total basin area. The Reassessment of water availability, volume 1 report published by Central Water Commission (CWC) in 2017 informs that the total basin area is 1,44,905 Km^2 (CWC, 2017). The Department of Water Resources, Government of Odisha in its web page on river basins informs that the total catchment area of Mahanadi river basin is 1,41,134 Km^2.

In area, Mahanadi is the sixth largest river basin in India and the third largest river basin in the peninsular India. Its basin area is nearly 4.3 percent of the total geographical area of the Country (India-WRIS, 2018). Table 1.1 below shows area of major river basins of India.

Table 1.1: Area of major basins in India

Sl No	River Basin	Area(Km^2)	Sl No	River Basin	Area(Km^2)
1.	Ganga	8,08,334.44	8.	Cauvery	85,624.44
2.	Indus	4,53,931.87	9.	Tapi	63,922.91
3.	Godavari	3,02,063.93	10.	Pennar	54,243.43
4.	Krishna	2,54,743.31	11.	Brahmani& Baitarani	51,893.70
5.	Brahmaputra	1,86,421.60	12.	Mahi	38,336.80
6.	**Mahanadi**	**1,39,659.15**	13.	Sabarmati	30,678.59
7.	Narmada	92,670.51	14.	Subarnarekha	25,792.16

Source: Compiled from India-WRIS, 2011

Water resources and runoff

While Mahanadi river basin is the third largest among peninsular river basins in area, this basin has the second largest water potential. The Integrated Hydrological Data Book published by CWC in 2012 informs, 'the average annual potential/average annual runoff in non-classified river basins is highest at 131 BCM in Godavari river basin followed by 61.95 BCM in Mahanadi'. It pegs the Narmada basin at the third position with 33.77 BCM and Krishna basin at fourth position with 26.74 BCM (CWC, 2012). However, earlier studies by CWC and a compilation by IIT, Roorkie informs that in terms of water potential, Mahanadi is the sixth largest river basin of India and among peninsular rivers it is the third largest water potential (CWC, 2012). Table 1.2 lists the earlier estimation of major river basins of India and their average annual water potential.

Table 1.2: Major river basins of India and their average annual water potential

Sl No	River Basin	Water Potential (Km^3)
1	Brahmaputra, Barak, and others	585.6
2	Ganga	525.02
3	Godavari	110.54
4	Krishna	78.12
5	Indus	73.31
6	**Mahanadi**	**66.88**
7	Narmada	45.64
8	Brahmani & Baitarani	28.48
9	Cauvery	21.36
10	Tapi	14.88
11	Subarnarekha	12.37
12	Mahi	11.02
13	Pennar	6.32
14	Sabarmati	3.81

Source: Compiled from IIT, Roorkie (2002)

A study report by P. Govind Rao informs that the mean annual river flow of Mahanadi river is 66 640 million m^3, which is 66.64 BCM (Rao, 1993). While many earlier compilations made by Central Water Commission (CWC) had pegged the average annual water potential of Mahanadi river basin at 66.88 BCM or 66.88 Km^3, the Integrated Hydrological Data Book published by CWC in 2012 had estimated that the 'average annual potential/average annual runoff' in Mahanadi river basin is 61.95 BCM. This means that the water resource potential of the Mahandi river basin has dropped substantially from the earlier estimations made by CWC and is substantially lower than the water resource potential estimated during formulation of the Hirakud project report. The Mahanadi valley development plan had said that, Mahanadi river 'has a mean annual runoff of 74 Million Acre Feet (MAF)', or about 91.3 Km^3 (Unified Basin-wide Plan, Mahanadi Valley Development Report, 1947). It gives a clear and startling indication that the water potential of Mahanadi river basin has dropped a whopping 16.3 percent of what had been estimated at the Hirakud project design stages in the 1940s.

Large fluctuations in monsoon & non-monsoon flow

All non-Himalayan rivers are mostly fed by monsoon rainfall and hence they have large seasonal variations in flow. Mahanadi gets most of its water in the South-East monsoon period within very short period of about 90 days. Table 1.3 shows share of monsoon and non-monsoon runoff in major peninsular rivers. Mahanadi gets about 88.3 percent of its total runoff in Monsoon months.

Table 1.3: Monsoon and non-monsoon flow of major non-Himalayan rivers (In MCM)

River	Monsoon (%)	Non-monsoon (%)
Mahanadi	5574 (88.28)	740 (11.72)
Godavari	7593 (94.83)	414 (5.17)
Krishna	4033 (94.32)	243 (5.68)
Kaveri	963 (70.09)	411 (29.91)
Narmada	6140 (78.6)	1 672 (21.4)

Source: Compiled from Integrated Hydrological Data Book, CWC, 2012
N.B.: Figures in bracket indicate percentage to total water potential.

Table indicates the large difference in water potential of the rivers in monsoon and non-monsoon period. Mahanadi gets about 88.3 percent of its total water potential in the monsoon season and a lowly 11.7 percent in the non-monsoon season.

River Basins in Odisha

The total geographical area of Odisha (1,55,707 square km) is divided into eleven river basins covering a geographical area of 1,50,460 square km and minor river basins of 5247 square km which drains directly into the Bay of Bengal. Out of eleven river basins, seven basins like Mahanadi, Brahmani, Subarnarekha, Nagavali, Vansadhara, Kolab and Budhabalanga are interstate either due to their origin or fall-out in the sea of the adjoining state. All the rivers flowing in the state are either originating from Central Plateau of India or Eastern Ghat region and flow along the direction of lower contour to join the main stream, which ultimately flow in eastward direction to join Bay of Bengal.

River Mahanadi

The Mahanadi is one of the major rivers of India, flowing east and draining into the Bay of Bengal. The Mahanadi River rises from Chhattisgarh and after throwing off numerous branches, the Mahanadi falls into the Bay of Bengal. Odisha is drained by 11 major rivers and their tributaries. Mahanadi touches part of Sundargarh, Jharsuguda Sambalpur, Baragarh, Sonepur, Balangir, Nuapara, Cuttack, Jagatsinghpur, Khurda and Puri districts.

For the first 80 kilometres of its course, Mahanadi flows in a northerly direction and runs through Raipur district and touch eastern portions of Raipur city. After being joined by the Seonath, the river flows in an easterly direction through the remaining part of its journey. It is joined by the Jonk and Hasdeo rivers before entering into Odisha, after covering about half of its total length near Raigarh and Janjgir Champa Districts of Chhattisgarh. Out of its total length of 851 km, it covers 494 km in Odisha state. It entered into Odisha at Sukhasoda of Jharsuguda District. Near the city of Sambalpur, it is dammed by the largest earthen dam in the world, the Hirakud Dam. Tel is biggest tributary of Mahanadi at Sonepur, from where again the river flows eastwards to join the Bay of Bengal. It then skirts the boundaries of the Baudh district. The River then rolls towards the Eastern Ghats, forcing its way through them via the 22 kilometres long Satkosia Gorge. The Satakosia Gorge ends at Badamul of Nayagarh.

The river enters the Odisha plains at Naraj, about 11 kilometres from Cuttack, where it pours down between two hills that are a mile apart. A barrage has been constructed here to regulate the river's flow into Cuttack. The river traverses Cuttack district in an east-west direction. Just before entering Cuttack, it gives off large distributaries called the Kathjori. The Kathjori then throws off many streams like the Kuakhai, Devi and Surua which fall into the Bay of Bengal after entering Puri district. The Kathjori itself falls into the sea as the Jatadhar. Traversing through the districts of Cuttack and Puri from west to east through a large number of distributaries, it has developed an extensive delta. Other distributaries of Mahanadi include the Daya, Bhargavi, Kushabhadra, Birupa, Chitroptala, Rajua, Makara, Malaguni, Genguti and Luna. Daya and Bhargavi flows into Lake Chilika.

CHAPTER - II

Mahanadi - An overview

Origin and broad topography

The Mahanadi River originates, at an elevation of 442 metre, from Sihawa hill range about six kilometers east of Farsiya village in Dhamtari district of Chhattisgarh state (India-WRIS, 2018). The origin is quite close to the administrative border of Odisha-Chhattisgarh states. Tributaries of Tel River - which is the second largest tributary of the Mahanadi River, originate from the other side of the same hill range. The nearest urban centre closest to the origin is Nagari, a Nagar Panchayat in Dhamtari district. The Nagari town is located about 64 kilometres south-east of district headquarter town Dhamtari and about 129 kilometres south of Chhattisgarh state capital city Raipur. From Odisha side, the origin of Mahanadi is located at a distance of about 100 kilometres from Dharmagarh in Kalahandi district and Sinapali in Nuapada district.

The basin consists of the Northern Plateau, the Eastern Ghats, the Coastal Plain and the erodible plains of Central Table Land. The first two are hilly regions. The Coastal plain is the fertile delta area. The elevation values ranges from a minimum of 0 m to a maximum of 1,321 m. The average elevation is about 321 m in the basin (CWC, 2017).

Major tributaries of Mahanadi River

The total length of the river from its origin to confluence at the Bay of Bengal is about 851 kilometres, of which 357 kilometres is in Chhattisgarh and the balance 494 km in Odisha (CWC, 2012). This means that Odisha has the larger share in length of Mahanadi River's main course.

There are 14 major tributaries of which 12 are joining Mahanadi River in the upstream of Hirakud reservoir and two downstream of it. On the Left Bank six tributaries, namely, the Seonath, the Hasdeo, the Mand, the Ib, the Kelo and Borai drain into main river channel upstream of Hirakud reservoir. The drainage system in upstream of Hirakud reservoir is more extensive on the left bank of Mahanadi as compared to that on the Right Bank. On the Right Bank, six tributaries namely the Pairi, the Jonk, the Sukha, Kanji, the Lilar and the Lanth join upstream of Hirakud reservoir and two tributaries namely Tel and Ong join downstream of it.

Seonath, Tel, Ib and Hasdeo are four of the most important tributaries of Mahandi river. Catchment areas of Seonath and Tel river basins alone constitute about 38 percent of the Mahanadi's total drainage area. Four major tributaries, namely the Seonath, Hasdeo and the Ib rivers on the Left Bank and the Tel river on the Right bank together constitute more than half, nearly 53 percent, of the total catchment area of the river Mahanadi (CWC, 2012). Seonath has the largest share in the catchment while Tel has the second largest catchment among major tributaries of the river.

Share of states in Mahanadi river's drainage area

If we consider total basin area of Mahanadi River as 141,600 Km^2, out of this about 74,970 Km^2 lies in Chhattisgarh state and about 65,600 Km^2 lies in Odisha. Maharastra, Jharkhand and

Madhya Pradesh have insignificant catchment area of the river. About 53% of Mahanadi's catchment area lies in Chhattisgarh and 46% in Odisha.

Both Chhattisgarh and Odisha have high stakes on Mahanadi as basin area of the river forms a significantly large part of both the states. The Mahandi River is considered as mother in both states as Mahanadi basin area forms 56.1% of Chhattisgarh's total geographic area and 42.15% of Odisha's total area.

Large variation in annual flow

The basin receives an average annual rainfall of 1,291 mm, of which about 90 percent is received from the south-west monsoon, i.e. from June to October (The Forum for Policy Dialogue on Water Conflicts in India, 2017). Annual rainfall of the basin varies from 923 mm to 1,905 mm and mean rainfall of these 30 years is found to be 1,317 mm (CWC, 2017).

At 75 percent dependability, annual flows in the Mahanadi river is 53.78 BCM (Ministry of Water Resources, 1999). The average annual flow of river Mahandi is quite deceptive as variation in annual runoff is quite large. The Forum for Policy Dialogue on Water Conflicts in India (henceforth Forum) found that the inter-annual flow in the river is highly variable, being as low as 20 Billion Cubic Meter (BCM) to as high as 70 BCM (Forum, 2017).

Studying the 30 year period from 1985-86 to 2014-15, the Central Water Commission found that the maximum annual water resource was 142.61 BCM during 1994-95 in 30 years and the minimum annual water resource was 31.77 BCM during 2000-01. The mean available basin water resource is 73.00 BCM (CWC, 2017)

Major projects in Mahanadi river basin and water usages

Many projects have come up in and across Mahanadi river and its tributaries. The WRIS, maintained by the ministry of Water Resources, informs that the total water resource potential of the Mahanadi river basin is 66,880 MCM of which about 50,000 MCM of surface water resource is utilisable. It mentions that 12,799 MCM of live storage capacity has already been created, which is 25.6 percent of the estimated utilisable water resource potential. WRIS further informs that 1,465 MCM of live storage potential is under creation (WRIS, 2018). Together it will be 28.5 percent of total utilisable potential. This is the created live storage only. It is obvious that the utilisation of water is much more than the live storage capacity. For example, total water withdrawal from Hirakud reservoir is about 14,195 MCM which is 2.4 times more than its live storage capacity.

The Forum had made an attempt to compile large and major irrigation projects in the Mahanadi basin. It informed that of the completed storages, 52 percent is in Odisha while the rest is in Chhattisgarh. Altogether, the CWC lists 253 dams and 24 barrages / weirs/ anicuts in the Mahanadi river basin. Of these structures, 74 are either major or medium irrigation projects (Forum, 2017).

Land use and agriculture status in Mahanadi basin

The Central Water Commission has mapped Land Use Land Cover (LULC) status of Mahanadi basin by using space inputs. The map indicates land use land cover status of the basin in the year 2004-05. The map indicates that Double/Triple crop (25.99 percent), current fallow (25 percent) and Scrub/Deg Forest (11.80) are the major classes in Mahanadi basin (CWC, 2017). Forest area is 29,74,000 and 24,00,000 in Chhattisgarh and Odisha respectively (Forum, 2017).

The Forum in 2017 made attempts to assess the status of agriculture in the Mahanadi basin. It

had found that the basin is predominantly agricultural with a mix of commercial and subsistence farming systems dominated by rice cultivation. While Chhattisgarh is mainly Kharif dominated, the study witnessed even three seasons of paddy cultivation in the irrigated belt of Odisha. Agriculture in the Mahanadi basin in Chhattisgarh is concentrated in the western uplands (Kawardha, Rajnandgaon, Bilaspur) and central plains (Durg, Dhamtari, Raipur, Mahasamund, Janjgir-Champa). In Odisha, agriculture is extensive in the western districts (Balangir, Bargarh, Nuapada and Subarnapur) and the coastal parts (Cuttack, Jagatsinghpur and Puri) of the state. In these regions, agriculture is supported by large-scale irrigation infrastructure, through major and medium projects. The northern and southern extremes of Chhattisgarh, as also the central regions of Odisha in the Mahanadi basin are more heavily forested and have smaller-scale rain-fed farming systems (Forum, 2017)

There are lot of confusion regarding irrigation potential created in Mahanadi river basin. The CWC in the 'Reassessment of water availability' report informs that the irrigation command area in the Mahanadi river basin was 30, 67,600 Ha in 2014-14. It was 13, 82,500 Ha in 2004-05 (CWC, 2017). The CWC had made this estimation based on completed dam and irrigation projects. It indicates that irrigation command area grew by 121.9 percent in a decade. This figure of irrigation command area does not tally with figures of net sown area in the basin estimated by different reports. As per Integrated hydrological data book prepared by CWC in 2012, the net sown area in Mahanadi basin was 23, 14,713 Ha in 2006-07 (CWC, 2012). NIIT-Roorkie has reported that net sown area in the Mahanadi basin was 48, 34,526 Ha (IIT-Roorkie, 2018). These figures do not tally as the command area reported by CWC in 2017 is higher than the net sown area, which is impossible.

Referring to the CWC's list of 253 dams and 24 barrages/weirs/anicuts in the Mahanadi river basin of which 74 are either major or medium irrigation projects, the Forum had concluded that the dams and barrages etc potentially provide irrigation cover to a gross irrigable area of 32.8 Lakh Ha - 15.4 Lakh Ha in Odisha and 17.4 Lakh Ha in Chhattisgarh. The forum had estimated that the irrigable area is 40 per cent of the 82.3 Lakh Ha Gross Cropped Area in the river basin (Forum, 2017). These varying figures show that there are serious data inconsistencies with regard to irrigation potentials created in the Mahanadi river basin.

Irrigation development is growing more rapidly in Chhattisgarh than in Odisha. However, total irrigated areas continue to be higher, though moderately, in Odisha.

Industrialisation in the Mahanadi basin area

The Forum did undertake an exercise to find out status of industrial water allocation to the industries by referring to the environmental clearances by the Ministry of Forest and Environment, Government of India. It revealed that the total amount of water in the Mahanadi basin allocated to large industries is about 1130 MCM in Chhattisgarh and 944 MCM in Odisha. This amounts to a total of 2074 MCM or about 1.7 MAF of water for industrial use which is about four percent of the total utilisable surface water in the Mahanadi Basin. About 1661 MCM (80 per cent) of water is allocated to thermal power generation alone, a steep increase from 364 MCM in 2007 (Forum, 2017).

Flood and Mahanadi

Mahanadi is one of the most flood prone basins of India. Flood is not a big problem in Chhattisgarh, but flood furies in Odisha is almost a regular feature. The Odisha state water plan (2004) has a full chapter on flood in

Mahanadi basin. The upstream catchment of Mahanadi is mountainous and has a steep slope. The catchment lies directly on the south west monsoon track and as such receives heavy rainfall during monsoon. Besides, the catchment area close to the sea is prone to heavy rain brought about by the cyclones generated in the Bay in September to November period. Thus, the catchment has the potential of producing very high flood. The delta area is plain and has a flat slope. In addition, flat topography of the delta area hinders flood water discharge and causes huge flooding (Odisha State Water Plan, 2004). On average, the basin receives 1,088 mm (millimetres) of rainfall during the southwest monsoon (mid-June to mid-October); as a result, the delta is subject to annual floods, which are aggravated by high tides and heavy rainfall directly on the delta (Sengupta et al, 2018). The deltaic drainage, which also burdens drainage of Baitarani River, is only 9,034 Km^2 spread. This small delta area against a huge catchment area of the basin is a major cause of flood in the Mahanadi system.

The Odisha Flood Committee Report (1928) had said, 'It has been calculated that the Mahanadi discharges, in maximum flood, about one and a half million cubic feet of water a second where it emerges from the hills above Cuttack, while, if a circle of 25 miles radius be drawn with its centre at that place, the branches of the Mahanadi, where they cross that circle, are capable of carrying only half that volume'. This causes high flood in the deltaic regions.

Hirakud dam and reservoir was primarily designed to protect the lower Mahanadi, more particularly the Mahanadi delta, from flood. However, many researchers have found that Hirakud reservoir has failed to moderate floods because of loss of storages and other priorities of the reservoir. Some researchers have also argued that Hirakud has augmented flood fury in the downstream in some years, especially in middle or late monsoon period. Climate change affecting rainfall pattern and large numbers of dams in the upstream of Hirakud reservoir have further strained and complicated Hirakud's flood mitigating capacity. A flood forecasting and inundation mapping study has found that while the original design flood for Hirakud Dam was 42,500 m3/s. More recent calculations indicate that the maximum probable flood is 69,500 m3/s, or about 63 percent greater than original calculation.

While the delta of the basin is historically highly flood vulnerable, the upper catchment area in both Odisha and Chhattisgarh are also facing floods, more in recent decades. This has made flood character of Mahanadi more complex.

Trans boundary River Conflicts

Presently two major basin states, Odisha and Chhattisgarh, are warring share over the Mahanadi water. A river dispute tribunal has already been set up to hear and adjudicate. However, the basin has many other kinds of conflicts as well.

Interstate conflict between Odisha and Chhattisgarh

The recent conflict over Mahanadi river water arouse, in mid-2016, when Odisha objected to construction of six barrages across Mahanadi river in the upstream of the Hirakud reservoir. Odisha complained that not only Chhattisgarh had kept Odisha in dark about the barrages; it has also committed fraud by submitting wrong facts to various bodies in the central government. Odisha is alleging that Chhattisgarh presented those barrages as minor irrigation projects whereas they are primarily intended to supply large water to industries. Chhattisgarh has on the other hand argued that it is entitled to use water of

Mahanadi river.

Odisha has alleged that because of impounding and obstruction by the barrages, non-monsoon inflow into Hirakud reservoir has significantly reduced. The Department of Water Resources, Government of Odisha, has issued press statements and also in a reply sought under RTI, has claimed that 'non-monsoon inflow in 2016-17 was recorded to be 41.1%, 32.9%, 30.9%, 39.2%, 27.6%, 73% and 77.8% less in November 2016, December 2016, January 2017, February 2017, March 2017, April 2017 and May 2017 respectively in comparison to average flow received during previous 10 years'. This alleged drop was huge. Odisha fears that the runoff will drop further as Chhattisgarh is planning to tap Mahanadi water through many more projects. The issue has snowballed into major issue, fuelled further by the fact that two opposing political parties rule the warring states.

The central government facilitated a tripartite meeting on September 17th, 2016. Chief Ministers of Odisha and Chhattisgarh and Union Minister for Water Resources with their officials and other important departments such as Central Water Commission representatives met to find solution to the conflict. Chief Minister of Odisha demanded that work on all ongoing projects in Mahanadi basin in Chhattisgarh state should be stopped for three months and an 'Expert Committee' may be formed to study the impact of projects in Mahanadi basin and give its report within three months. Chief Minister of Chhattisgarh said that 57% of Mahanadi water is flowing to sea without any use in the basin. The Mahanadi River has sufficient water to meet the requirements of both the states. He suggested forming a 'joint control board' as mentioned in 1983 agreement between Odisha and erstwhile Madhya Pradesh states. Chhattisgarh government said that since the projects are in advanced stages of completion, they will not stop construction. Union Minister asked the states to put on hold the project construction works for one week.

The central government claimed that following decisions were taken in the meeting:

a. A special committee will be formed which will list out the water resources projects in Odisha and Chhattisgarh those have been constructed or are under construction without the approval of the Technical Advisory Committee of MoWR, RD and GR. The committee will submit a report within a week's time.

b. The gauge and discharge sites will be opened at interstate border of Odisha and Chhattisgarh at a location for effective measurement of flows from Chhattisgarh catchment into Hirakud dam.

c. A detailed study of water availability of Mahanadi may be carried out by National Institute of Hydrology, Roorkie.

d. Formation of an Expert committee, as suggested by Odisha, will be formed.

However, government of Odisha objected to Chhattisgarh's refusal to stop construction of barrages and decided to not cooperate with any committee. Later Odisha government asked the central government to constitute to Mahanadi River Dispute Tribunal under Inter-states River Water Dispute Act, 1965. Complaining that Central government is siding with the state of Chhattisgarh and delaying redress, Odisha government approached the Supreme Court to seek a direction to the Central government to constitute a Tribunal. The Supreme Court, on January 24, 2018, ordered the Central government to constitute Mahanadi River Dispute Tribunal within one month. Central government failed to constitute the Tribunal within the stipulated time and the cabinet took a decision in this regard only on February 20, 2018. On March 12, 2018, the Central government issued notification regarding constitution of the Mahanadi River Water Dispute Tribunal.

Prior to Odisha government's approach to the Supreme Court of India, a civil society body 'Mahanadi Bachao Andolan' had sought intervention of National Green Tribunal (NGT) against construction of barrages and other projects in Chhattisgarh. That matter is pending in the NGT.

Run-off at Hirakud

The Hirakud dam project report had estimated that the 'Mean Annual Runoff' at the dam site was 50 Million Acre Feet (MAF) from1926 to 1946. It had, further, estimated that the 'Maximum Runoff' was 69.9 MAF and 'Minimum Runoff' was 20.61 MAF. A close observation of the runoff at Hirakud clearly reveals that while mean annual runoff has decreased substantially, the site has also registered higher runoff than the previously observed maximum runoff and lower runoff than previously observed minimum runoff. In the year 1961 total annual runoff at Hirakud was 73.63 MAF, significantly higher than the previously observed 'maximum runoff' of 69.9 MAF. Similarly, in the 59 years since 1958, the total annual runoff at Hirakud has been less than the previous observed 'minimum runoff' in as many as 21 years. That means while the annual run-off is on a decreasing trend, it has become more extreme.

CHAPTER- III

Research Methodology

Focus of the Study

i) Study the life and livelihood dependency of River basin communities of Mahanadi River both as upper and lower riparian.

ii) Understand impact of inconsistent water inflow and pollution in River Mahanadi on riverine communities and river eco-system and community water governance.

iii) Socio-cultural, economic & religious impact on communities –especially on women of diminishing water quality and quantity in River Mahanadi

Objective of the study

General Objective

To understand river water governance of River Mahanadi through studying the people's perspective on River and water governance in both Odisha and Chhattisgarh to arrive at pro-poor and pro-riparian policies that benefit them as well as the rivers' ecosystems.

Specific Objective

1. To study the life and livelihood dependency of people on River Mahanadi those are living in Mahanadi basin like farmers, fishermen and artisan communities.
2. To analyze secondary Data on River flow, decline groundwater and other water resources, pollution, human made obstructions on River and impact of Climate Change etc.
3. To understand people's perspective on issues related to Mahanadi.
4. To share the river basin people's issues and concerns with different stakeholder including government.

Table 3.1 Save Mahanadi, save livelihood Study Journey / Timeline

Sl. No	Time	Events
1.	1st Week of December 2017	The concept to do a study on river Mahanadi and life and livelihood of Basin Communities was discussed
2.	19th – 23rd Dec. 2017	Padyatra (Mahanadi Banchaa jibika banchaa) from Lara (Chhattisgarh) to Cuttack along Mahanadi river started from Lara
3.	22nd Dec. 2017	Padyatra ends with meeting at Cuttack
4.	February to July 2018	Data collection from different identified begins
5.	June - July 2018	Data collection and analysis of data completed
6.	30th June 2018	Sharing of People's perspective with Government of Odisha

The study was undertaken in 10 Districts of Odisha & Chhatisgarh. 36 villages in 8 districts (Jharsuguda, Sambalpur, Subarnapur, Boudh, Angul, Nayagarh, Cuttack, Jagatsinghpur, Khorda and Puri) of Odisha. 4 villages from 2 districts (Raigarh & Janjagir Champa) of Chhattisgarh were covered under this study.

Study Universe

Table 3.2 List of sample states, districts, blocks, gram panchayats and villages covered

State	District	Block	Panchayat	Village
Chhattisgarh	Raigarh	Sarangarh	Kalma	Saradih
		Raigarh		Basantpur
Chhattisgarh	Janjgir Champa	Dabhra	Debara	Basantpur
		JaiJaiPur	Jayantpur	Kikirda
Odisha	Jharsuguda	Rengali	Khinda	Nuakhinda
			Kandheikela	Mahulpalli
				Sukhasoda
				Kandheikela
Odisha	Sambalpur	Maneswar	Bateimura	Khunti
			Bhoipali	Bhoipali
		Sambalpur	Badabazar	Badabazar
		Hirakud NAC	Mahmadpur	Mahmadpur
		Dhankauda	Talab	Sonutikra
Odisha	Subarnapur	Binika	Mahadebapali	Gariapali
				Jharapada
		Birmaharajpur	Bagbar	Buroghat
			Uphula	Khambeswaripalli
			Mahada	Bhudobar
Odisha	Boudh	Harbhanga	Radhanagar	Krushnamohanpur
			Dhalapur	Khandi Dhalapur
			Kankala	Kankala
Odisha	Angul	Athmallik	Jamudoli	Jamudoli
			Luhasinga	Luhasinga
			Aida	Bahali
Odisha	Nayagarh	Gania	Rasanga	Ostia
			Chhamundia	Chhamundia
				Badmul
		Khandapada	Kantilo	Kantilo
Odisha	Cuttack	Narsinghpur	Jayamangal	Ghoradia
				Dhanipur
		Baidyeswar	Golaganda	Sampur Dal
			Anuary	Anuary
Odisha	Jagatsinghpur	Biridi	Manguli	Sankhari Sahi
			Biridi	Kulakaijangh
			Ukulara	Allipada
		Paradip Lock	Biswali	Biswali
Odisha	Puri	Kanasa	Andarsingha	Andarsingha
			Gada Balabhadrapur	Gada Balabhadrapur
			Chupurungi	Pahilundi
Odisha	Khordha	Tangi	Balipatapur	Saraswati Nagar
2 States	**12 Districts**	**21 Blocks**	**34 Panchayats**	**40 Villages**

Sample design of the study

The study adopted stratified random sampling for choosing different villages according to the requirement of the study. It has covered two States such as Chhattisgarh and Odisha from Mahanadi River Basin. From both the States 40 villages were identified according the following criteria (i) villages near to the river Mahanadi (within 2 kilometers) (ii) Villages where the life and livelihood of communities depend prominently on River Mahanadi (iii) Artisans and specific communities those depend upon Mahanadi for their traditional livelihood.

Tools and techniques used for data collection

Both qualitative and quantitative data collection methods are used for collection of primary and secondary data. For primary village level data collection a questionnaire was developed. To get response on demographic, socio-economic status, use of river water, changes perceived impact on livelihood, challenges faced by them, knowledge on issue between Chhattisgarh and Odisha, pollution in River and commitment on water governance questions were formulated. Focused Group Discussion with groups like farmers, fisherman, artisans, women and youth were conducted to know their prospective.

Table 3.3 Gender distribution in study villages

Distribution of gender in study villages according to gender			
	Total Population	Female	Male
Raigarh	870	425	445
Janjgir Champa	5873	2937	2936
Jharsuguda	7309	3573	3736
Sambalpur	4977	2438	2539
Subarnapur	2371	1148	1223
Boudh	1183	570	613
Nayagarh	10719	5211	5508
Angul	2551	1234	1317
Cuttack	1323	622	701
Jagatsinghpur	9340	4530	4810
Puri	3877	1912	1965
Khordha	308	149	159
Total	**50701**	**24749**	**25952**

Table 3.4 Social group distribution of study households

Distribution of household according to different social group category										
	Total HH	Total Population	SC	%	ST	%	OBC	%	Gen	%
Raigarh	197	870	42	21	80	41	39	20	36	18
Janjgir Champa	1327	5873	131	10	75	6	641	48	480	36
Jharsuguda	1466	7309	425	30	301	20	623	42	117	8
Sambalpur	1009	4977	187	19	406	40	333	33	83	8
Subarnapur	566	2371	218	39	2	0.35	151	27	195	34
Boudh	241	1183	174	72	37	15	30	13	0	0
Nayagarh	2493	10719	819	33	2	0.08	1195	48	477	19
Angul	644	2551	173	26	3	0.46	463	72	5	0.78
Cuttack	355	1323	161	46	23	6	17	5	154	43
Jagatsinghpur	1575	9340	342	22	0	0	918	58	315	20
Puri	842	3877	201	24	0	0	415	49	226	27
Khordha	77	308	70	91	0	0	5	7	2	2
Total	**10792**	**50701**	**2943**	**27**	**929**	**9**	**4830**	**45**	**2090**	**19**

Data analysis

The data collected from primary source are processed through MS Excell and analyzed to know about demographic details of the area, traditional use of river water and recent changes on those uses. What the people think about such changes and the causes behind it? How they get benefit or lose for those changes. What measures they have taken to deal with problems and how the livelihood of people affected. Whether they are aware about the recent political discourse between Chhattisgarh and Odisha? Whether such issue formed part of political agenda in their respective area? What recommendation they suggest to the government to deal with the issue. The secondary information was collected from reports and records of the central as well as state govt. statistics, book and policy documents.

Study Limitations

1. The small representation from villages may not give a clear statistics of the problem as a whole but only focus light on issues.
2. The small representation of artisans (brass artisans in Nayagarh) and specific communities (Jhara Communities of Boudh and Subarnapur) may not give a clear picture of their sufferings or deviation from their traditional occupation.
3. The transboundary aspect of the issue is not covered systematically due to paucity of time, with proper representation from Chhattisgarh.

Chapter – IV
Study Findings

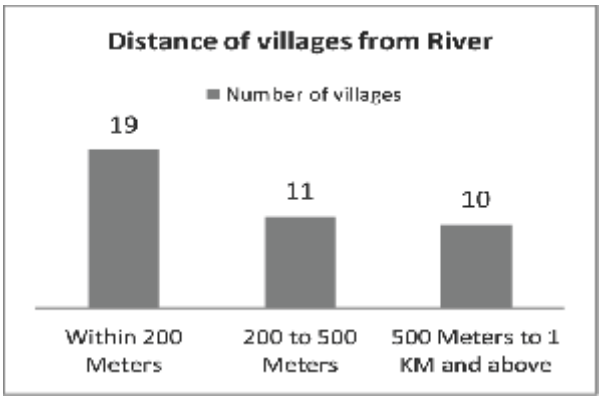
The village level information on responses to issues relating to reduced water inflow in River Mahanadi and its impact on life and livelihood of River basin communities was collected from twelve districts of Chhattisgarh and Odisha. Some major questions raised were - dependency on the river; changes in river morphology; impact due to these changes; increasing difficulties; factors furthering vulnerability of riverine communities; local community's perception of issue between Odisha and Chhattisgarh, awareness and participation in decision making process, specific impact on women and impact due to pollution.

Sample Village Profile

The villages were identified on different criteria from different districts of Chhattisgarh and Odisha at confluence of River Mahanadi. The investigators conducted focused group discussion in the villages. An overall profile of the communities from forty villages, twelve districts of Odisha and Chhattisgarh was created. These profiles provide studied village details on account of – settlement, population, sex ratio, caste, religion, coverage under government safety net and status of land holding. The analysis gives a clear picture of villages in relation to Mahanadi River.

Location of villages shows their dependency on River

There are number of settlements on bank of Mahanadi River both in the state of Chhatisgarh and Odisha. The life and livelihood of people in all those villages are completely dependent on River. Out of 40 villages studied, 19 villages are situated close to river bank within 200 meters from river. 11 villages are within 200 to 500 meters and 10 villages are within 500 meters to 1 kilo meters from River. This indicates that around 50 % of villages close to river bank have been studied. This is to study different dimensions to people's relation to river in terms of distance.



Religious Group

The study found 100 % households in all sample villages belongs to Hindu religion. Historically this belt is Hindu dominated and they have close relation with river in terms of their socio, religious and cultural identity. The study could not find any other religious groups at any villages covered under this study. Temples and other Hindu religious palaces are found almost in all villages which indicate the relation between river and religion. People, especially women perform different rituals in different times throughout the year on river bank.

Table 4.1 Distribution of houses as per their religion

Distribution of houses as per their religion				
District	**Total HH**	**Total Population**	**Hindu**	**Percentage**
Raigarh	197	870	870	100
Janjgir Champa	1327	5873	5873	100
Jharsuguda	1466	7309	7309	100
Sambalpur	1009	4977	4977	100
Subarnapur	566	2371	2371	100
Boudh	241	1183	1183	100
Nayagarh	2493	10719	10719	100
Anugul	644	2551	2551	100
Cuttack	355	1323	1323	100
Jagatsinghpur	1575	9340	9340	100
Puri	842	3877	3877	100
Khorda	77	308	308	100
Total	**10792**	**50701**	**50701**	**100**

Government Safety Net

Mahanadi is a vital source of economy for river bank communities. It provides opportunities for the people to earn their livelihood. But people's dependency on river and opportunities reduced over the years. As a result people have started depending on alternative sources provided by Government. In order to study people's dependency on different Government schemes and coverage, information was collected from all household on major government safety nets like MGNREGAS, Annapurna, Antodaya, Housing, ICDS and pension. It was found that all households are linked to one or other schemes run by Government in their villages. This is an indication of increasing people's dependency on Government schemes rather than depending on river for their day to day livelihood. People in covered villages observed that all these schemes are highly helpful to them but there are irregularities in implementation and reaching benefit in time to the people. This finding also reveals increasing level of awareness among people on Government schemes.

Land Holding Status

Land profile of the sample villages indicates that all villages have some amount of irrigated land, non-irrigated cultivable land and common land. Major land holding is homestead land followed by un-irrigated land. As most of the villages are very near to River, they are able to irrigate land. However, now the trend is continuously changing because most of the villages are unable to irrigate their land for non-availability of water in River Mahanadi. Defunct lift irrigation system is another reason for lack of coverage of large patch or land available for cultivation purpose. However, lift irrigation system is available to irrigate land in some patches. Village commons are basically pasture land available for grazing of livestock.

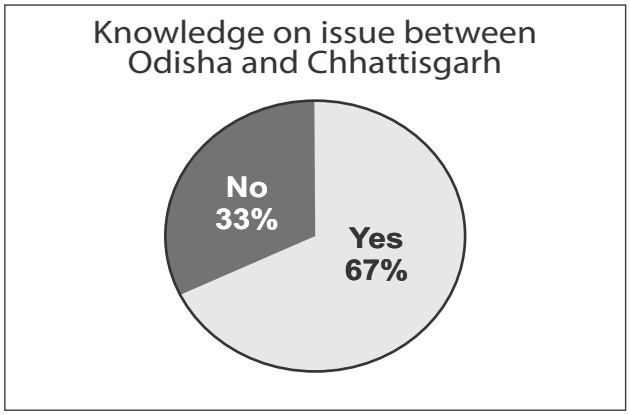
Table 4.2 Land Holding Status

Districts	Total land (Land in Hectors)	Homestead Land	Cultivable irrigated	Un-irrigated	Common land
Raigarh	196	120	8	57	11
JanjgirChampa	1563	632	120	737	74
Jharsuguda	1357	754	53	445	105
Sambalpur	757	217	410	45	85
Subarnapur	362	135	190	0	37
Boudh	311	167	9	115	20
Nayagarh	2403	1479	126	735	63
Angul	983	549	22	375	37
Cuttack	563	321	27	137	78
Jagatsinghpur	477	200	225	0	52
Puri	615	212	335	20	48
Khordha	95	45	30	10	10
Total	9682	4831	1555	2676	620

Ground Realities

Awareness about the issue between Odisha and Chhattisgarh

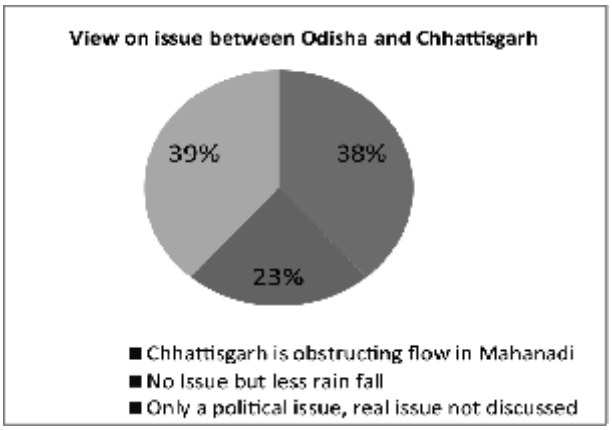
People in the study area are aware that there are conflicts between Odisha and Chhattisgarh



on the issue of construction of barrages by Chhattisgarh at upper stream of Mahanadi which cause less water flow in Odisha. Majority of them told that they are aware about this issue as all news agencies are now discussing this issue. 67 percent people stated that they are aware about the issue. However, most of the people stated that the real issues and problems of river basin communities are never discussed and both the governments are not serious about it. Only 33 % respondent expressed that they are not completely aware of conflict between two states.

View on Issue between Odisha and Chhattisgarh

As regards to people's opinion about Mahanadi River issues, people are aware about conflict between Odisha and Chhattisgarh on River Mahanadi. 38 percent people stated that Chhattisgarh has constructed many barrages and obstructed the flow of Mahanadi and thus



the inflow to Mahanadi in Odisha is drastically reduced. However, 39 percent people have a different view and they stated that the issue is hyped by political parties and they are not concerned about the problems faced by people whose life and livelihood is depending upon River Mahanadi. Both State Governments of Odisha and Chhattisgarh are mostly concerned about the water demand by industries and intend to establish more

industries and provide them water. They are least concerned about water demand by farmers, fishermen, artisans or in maintaining minimum environmental flow in the river. Only 23 percent people stated that water inflow in River Mahanadi is reduced, but it is not that Chhattisgarh is obstructing all water, but there is less rainfall in last few years and thus it affected the inflows towards Odisha.

Different uses of River water

Minimum environment flow plays an important role in maintaining the eco systems and natural life habitats. They form part of the food chain from vegetative products to aquatic creatures like fish, crab, shrimp and many more species. As indicated in the data, communities settled on various river banks use river water for varied purposes and their perception of river water use too varies widely. There are multiple uses of river water by communities like drinking, fishing, irrigation, navigation and number of cultural and religious activities. 87 percent people used Mahanadi River for fishing purpose as most communities are depending upon fishing as their primary livelihood option. 77 percent villages used it for irrigation purpose. 37 percent people use river water for drinking purpose. 32 percent are using it for navigation and 57 percent for cultural use. Communities from Chhattisgarh are using only for irrigation and fishing which is now again not possible as they have less access to water after construction of barrages. Due to severe pollution many places in Odisha people no more use water for drinking purpose. However, in Puri and Khordha people are forced to use River water for drinking purpose despite pollution because the alternative sources are either not available or those are also contaminated. Villages in Nayagarh and Boudh districts are residing in protected areas of Satakosia and thus they are not using river for irrigation or drinking purpose. Due to less water availability and construction of different water harvesting structures most of the people are now not using river as means of transportation.

Table 4.3 Distribution of households as per water use pattern

Districts	Irrigation	Drinking	Cultural	Fishing	Navigation
Raigarh	2	0	0	2	0
Janjgir Champa	2	0	0	2	0
Jharsuguda	4	4	4	4	2
Sambalpur	5	2	1	5	1
Subarnapur	3	2	3	3	2
Boudh	0	1	2	3	1
Nayagarh	0	0	4	4	0
Angul	3	0	1	2	0
Cuttack	4	2	3	2	1
Jagatsinghpur	4	0	1	4	2
Puri	3	3	3	3	3
Khordha	1	1	1	1	1
Total	**31 (77%)**	**15 (37%)**	**23 (57%)**	**35 (87%)**	**13 (32%)**

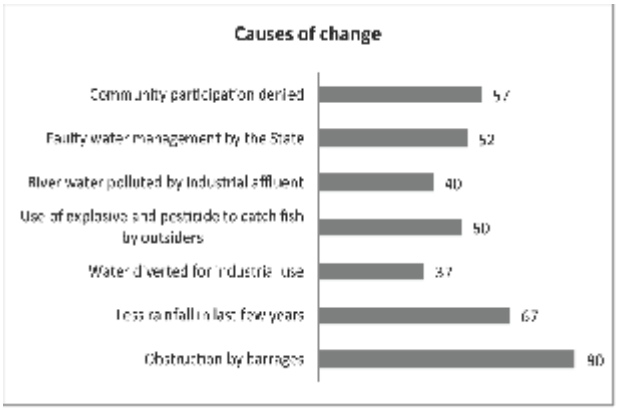
Recent changes observed on use of River water

Over last four to five years, communities have experienced a shift in the pattern of river water use. The overall scenario depicts that there is less water for irrigation purpose, no water to catch fish throughout the year, no flood for last few years, pollution level increased and much less water is available to perform rituals. 82 percent people stated that there is less water available for irrigation. 85 percent people stated that there is no flood in last few years and it is a loss for them as the top soil deposit with flood makes the land more fertile. Now

they use more fertilizer which increase the cost of cultivation and also pollute river water. River basin communities are affected as they lost their livelihood 93 percent people stated that they will not be able to catch fish from River throughout the year which is their primary livelihood option. Now they are only able to catch fish in rainy season and forced to alter their livelihood and most people migrate to other places in search of livelihood. Many villages are depending upon River for drinking water purpose. 70 percent stated that due to less inflow in River and urban and merger of industrial affluent in River, the water is getting polluted and they are forced to drink polluted water. In most of the areas in bank of Mahanadi like Boudh, Nayagarh, Angul and Cuttack are suffering from kidney and other waterborne diseases. Many people observed depletion of ground water and complained about drying up of other water sources due to less water availability in River. 75 percent people observed such changes. 32 percent people observed less water for transportation.

Reasons for Change

Community members feel that major reason for change has been obstruction of river flow followed by declining rainfall in last few years. Community participation in water governance system is another reason for such change as

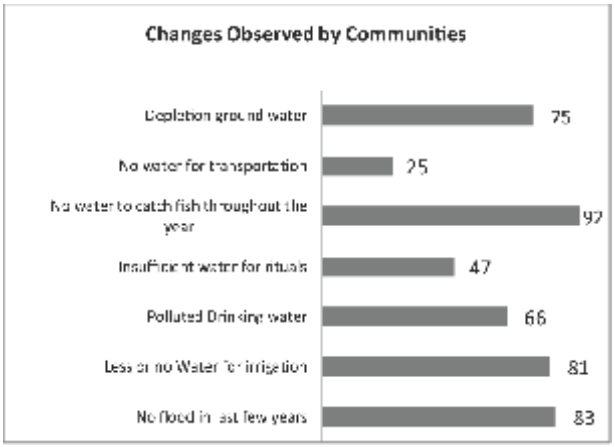


they were never consulted before any activities by government on river basin activities. In people's lives, the main changes are attributed to causes varying from obstruction of river flow at upstream by neighbouring State to less rainfall, improper water governance system and failure of community water management system.

Almost 90 percent people observed that construction of barrages as the main threat for their suffering, while 67 percent villagers observed that there is less rainfall in last few years and thus the inflow in river is decreasing. 37 percent villages observed that most of the water allocated to industries and such diversion is the main cause for less water in the River. 50 percent people mostly those are depending upon fishing for their primary livelihood option observed that use of explosive and pesticide to catch fish, pollute water and fish availability is decreasing drastically. They are using it to get immediate benefit as they cannot get fish throughout the year. Improper governance of water by state has been perceived as another reason by 52 percent people. There is enough water in the river basins to provide livelihoods to its residents for a long time provided water is managed efficiently, equitably and that additional water is made available not just through storage.

People Affected by the Change

Water scarcity and inadequate flow has impacted communities adversely on many fronts. People shared that, major concerns have been drying up of alternative water sources like village pond and open wells



around 75 percentages. Both have dried as a result of water scarcity in river during the lean season. Both the factors combined has resulted in declining crop production 87 percentage, people migration in search of alternative livelihoods 87 percent and 82 percent fisher folk are forced to change their occupation.

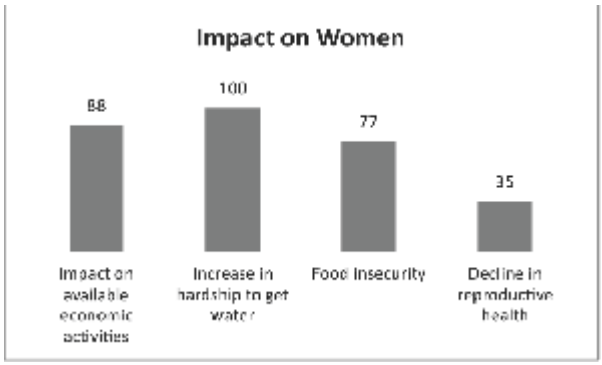
The current interventions by the upstream State by constructing barrages only harm the agro-ecological and economic wellbeing of people residing alongside the river. The locals are familiar with the flood which is productive for them and their land become fertile and use of chemical fertilizers was very negligible. However, now without any flood for last few years 70 percent people expressed increased use of fertilizer. People alongside the river basin knew how to live with floods. They did not try to control the river but gathered around them; good fish catch and agricultural products. Now 35 percent women are not getting proper livelihood options from the river. It has been observed that women from Jhara communities in Boudh and Subarnapur district who were used to collect gold from River Mahanadi as their traditional practice. Now due to less water in River they spend more time in river and get little amount of gold. 42 percent people stated that they were using river water for drinking purpose and now that is not available. Around 37 percent people observed that consistently flow of water is diminishing and to get water for irrigation through lift irrigation, farmers spend more money. The local opinion is that construction of barrages and big dams destroyed the flow of the river and devastated people living on its sides.

Table 4.4 People affected by changes.

How people affected	Number of village responded	Percent %
Without flood, soil fertility is decreased and fertilizer use is increased	28	70
Extra costs involve to get water for irrigation	15	37
Less crop yield	35	87
Problem to get safe drinking water	17	42
Not able to follow rituals properly	17	42
Fishermen forced to change occupation	33	82
People migrate in search of livelihood	35	87
Women loss their livelihood	14	35
Alternative water source dried up	30	75

Impact on women

In any adverse condition, women get affected first. In the case of Mahanadi water crisis also the same thing has happened. Responsibility of collecting water for household consumption is the major responsibility of women; hence 100% women feel the burden of water collection for household chores. Apart, their economic activities like collection of gold by Jhara community, collection of fish, preparation of mat by collecting grass and vegetable farming on river flood plain has suffered badly and 88% women feel loss of livelihoods. Grass collected from flood plain area was used for preparing small baskets and

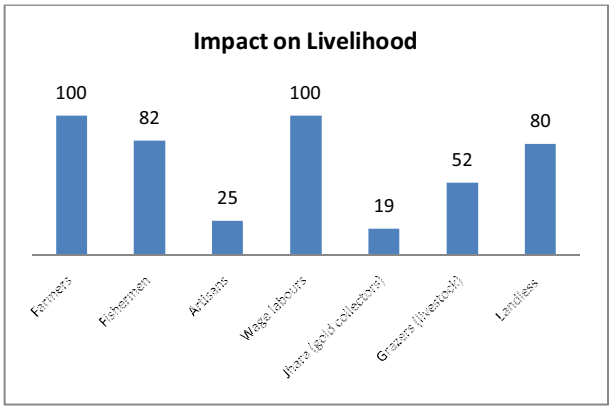


other utility items. Often those were sold in the nearby market for livelihood purpose. Faulty river water management system and its impacts such as bio-diversity degradation and food insecurity have affected women in the study locations adversely. Women get less information as their participation in decision making is negligible. Increased workloads prevent them from participating in the formal decision making process. The impact of river degradation and devastation is experienced by women in three specific areas: direct impact of available economic activities, increase in hardship and decline in reproductive health.

Women also mentioned about increase in workload in managing food for their families due to reduced income and loss of assets. Due to less water availability in River and dried up in patches, people are not able to keep livestock and maintain kitchen gardens. This has ultimately impacted their nutritional food intake leading to malnutrition. Reduced income from traditional sources has forced women to be dependent on other livelihood option like daily wage labour. Women are responsible for collecting drinking water from distant; this becomes an extremely arduous and difficult and time consuming task. Apart from this, the overall health of women gets affected because of deterioration of nutrition. The women from Jhara community are spending more time standing in water, affecting their health adversely. Due to less water in River, women are not able to perform cultural and religious activities. This has resulted in cultural, social isolation and extinct of traditional practices in many pockets of the study area. People fear that the next generation may never get to know and learn about their rich cultural heritage- that has been a part of river valley civilisation.

Impact on different livelihood

Agriculture, fishing, livestock rearing, crafting are the major source of livelihood. These are becoming increasingly vulnerable because of the less water inflow in River Mahanadi. Crop loss is now a regularphenomenon due to no water for irrigation and 98 percent

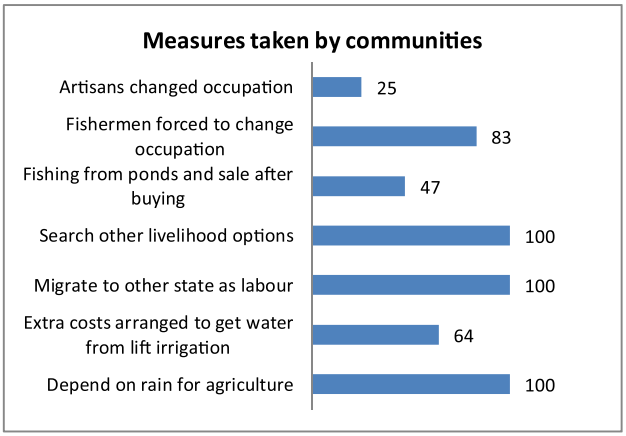


people stated that agriculture is drastically affected and farmers are now either forced to migrate or worked as wage labour. 100 percent villages stated that they have lost their wages and other livelihood options. In some place artisans are depending upon Mahanadi river water for crafting. For instance brass artisans in Kantilo area of Nayagarh districts came from Southern parts of Odisha and got settled on bank of Mahanadi as charcoal and water were available n plenty. However, now with less water inflow in River Mahanadi they are not able to continue with their traditional livelihood option. Now most of them shifted to other livelihood options. 25 percent villages stated that the artisans have been affected. Fishermen community is affected significantly as now they don't' have sufficient water to catch fish throughout the year. 82 percent villages stated that fishermen are affected and they have mostly changed their livelihood or migrated to Kerala or working as labour to catch fish from sea. Livestock population has substantially declined due to the non availability of sufficient grazing land and 52 percent people stated that they are not able to continue with livestock rearing. Jhara communities in Boudh and Subarnapur district are mainly depending upon collection of gold from sand of Mahanadi and traditional way of

fishing. Previously one person was able to collect 10 grams of gold in a week and get benefit and keep it as their primary livelihood option. However, now as the inflow in Mahanadi is disrupted they are not able to collect gold and only women from their family are going to collect and get very little amount gold and only able to get 200 rupees in a week. 19 percent villages where the Jhara community is residing are completely affected due to non-availability of water in Mahanadi. Landless people mostly dependent upon flood plain areas to cultivate vegetables to earn and now with less water in River 80 percent villages stated that they are not able to earn from this source.

Steps taken by communities to deal with livelihood issues

As the river basin communities are getting affected due to less water inflow in River Mahanadi and forced to change their principal



livelihood option, they also have taken some measures to deal with the issue. Now 100 percent people stated that they are not able to irrigate their land and they are depending upon rain for their kharrif crop. In most cases they are only getting single crop. In some villages farmers spent additional amount to get water for lift irrigation point. 64 percent people in Subarnapur, Sambalpur, Jharsuguda, Angul and Cuttack, stated that they are spending 60 thousand to 1 lakh rupees in a year to dredge the river to take water from its flow to lift irrigation point to get water for irrigation. 100 percent people stated that people are migrating to other states in search of other livelihood option. Many artisans changed their traditional livelihood option and now working as labour and 100 percent people stated that fishermen and other traditional artisans have changed their primary livelihood option.

Collective measures to deal with issues

Though the problem around life and livelihood of river basin people is severe and need proper attention, but collective measures by the communities is very negligible. As most of the area are depending upon lift irrigation system the user farmers' collective i.e. Pani Panchayat is existing in some area and in case of difficulties they tried to intervene. In 80 percent villages it exists but not effectively involved in solution of the problem. In 77 percent villages the fishermen cooperative are existed but they never tried to look into the livelihood options of fishermen communities. Women self help group and people's organisation are mostly not present and effectively working. Only 20 and 12 percent villages have such collectives but not able to deal with the river water issue.

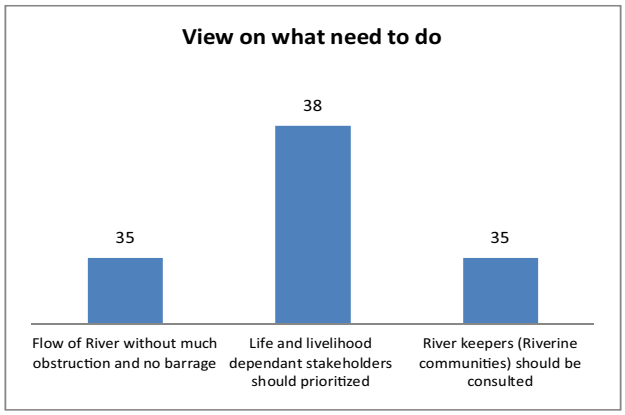
Table 4.5 Collective measures to deal with issues.

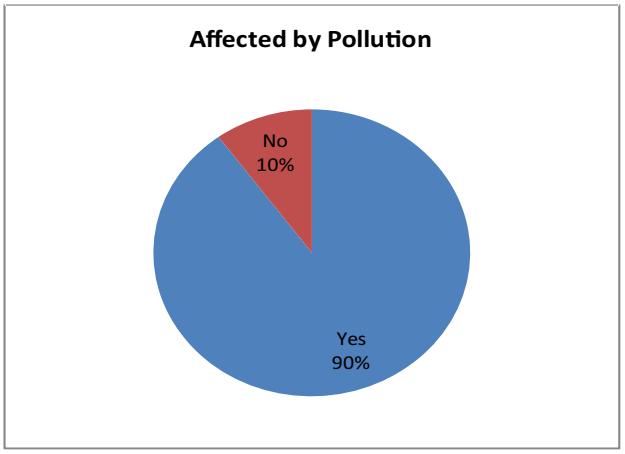
Institutions	Number of village responded	Percentage %
Pani Panchayats	32	80
Fishermen Cooperatives	31	77
Farmer's Organisation	10	25
Women's self help group	8	20
People's Organisation	5	12

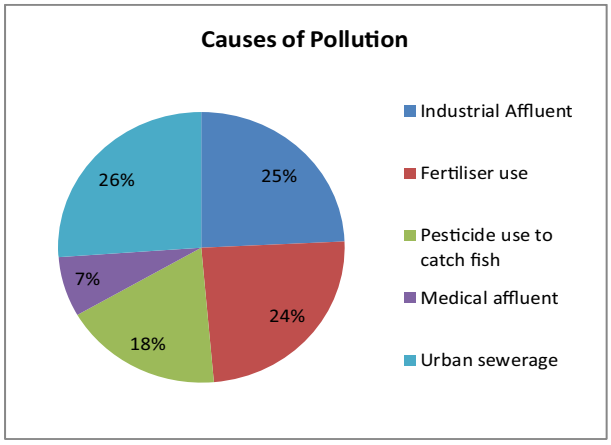
Impact of Pollution on water

While discussing the impact of pollution on water majority 90 percent felt that water was polluted while only 10 percent felt that there was no pollution. This indicates that water pollution level has gone to an alarming stage

for being visible to larger community. Mahanadi water is no more clear and safe, like it used to be before two to three decades. Community members in the study villages shared their view on water pollution. Now the water is polluted by different pollutants, highest being use of fertiliser 27 percent, followed by urban sewerage 25 percent, industrial affluent 23 percent, and pesticide used for fishing purpose 18 percent. There is a need to control these three major pollutants to keep river water safe for consumption.







Community views on what needs to be done

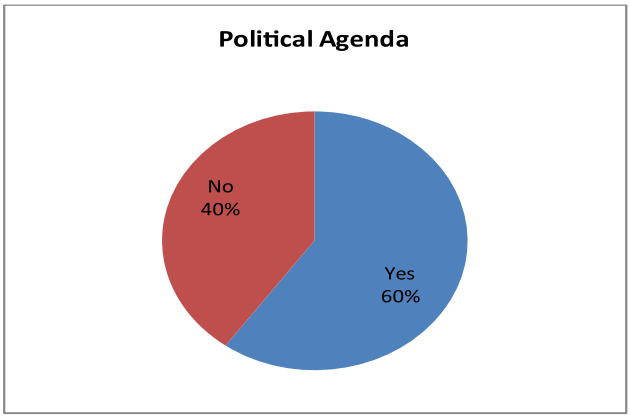
The study tried to capture community views and suggestions for steps to be taken in dealing with interstate river water issues. People have suggested many practical actions during the discussion. The study team could record the following recommendations.

Across all districts, communities felt that government should give priority to the communities whose life and livelihood completely depend on River Mahanadi in case of water allocation or any river related decision. 38 villages i.e. 95 percent people stated that right to river and rights of river should be prioritized and first stake on river has to be ensured to the river basin Communities. Community consultations before taking any decisions was given importance and 87 percent people stated that the riverine communities who are the real protector and conserver of river should be consulted before the governments took any decision on river. People further suggested that community participation must be ensured before taking any decision on river water sharing. Communities from 35 villages stated that there is no need to construct barrages on river and the flow of river should be maintained without any obstruction. A further point of contention is that only bilateral relations with co-riparians are not sufficient but needs a total basin approach for proper management of river water. Community water management, especially by women needs to be prioritised. Water allocation needs to be balanced between industrial, agricultural and household use and community needs to be involved in

decision making process.

Whether Mahanadi issue is a political issue

As the water problem bothers people on ground, they feel it has now become more of a political agenda rather than people's concerns over water and related challenges they face on ground. 60 percent people felt political parities are politicising this issue, while rest 40 percent said no to their role.



Because Mahanadi water is now a political issue as the MLA, MP, Sarpanch are coming to their area to discuss this, now there are several campaigns by political leaders to save Mahanadi and to take the mileage. While the same people remained silent when Chattishgarh built barrage up stream. 40 % villages stated that the political leaders never discussed on the issue of Mahanadi and their plight.

People's Voices

Decreasing Water, Depleting Fish and Diverting Livelihood

≈≈ Basudev Behera aged about 46 years is a fisherman from Sankhari Sahi, Baish Mauza of Biridi block of Jagatsinghpur district. The village is on the bank of river Devi which is connected to river Kathajodi at Cuttack. Kathajodi is the right branch of Mahanadi.

"Due to reduced water flow in Mahanadi, livelihood of fisherman community depending upon river have been badly affected. I am a fisherman; our entire family's needs were met through fishing from the river and selling in nearby market. We have not seen any floods in the river for the last five years and water availability has come down and it has become more polluted and infectious to human body. The income from fishing has been reduced to almost 50%. Because of this crisis, many families have migrated outside Odisha in search of alternative livelihood options" says Basudev. Thus, the traditional livelihood system that is ingrained in Mahanadi has been affected compelling large number of families to be wage labourers.

People said, variety of fishes were available in adequate quantities, but now a days it has reduced drastically. Thus, income of the fishing community from fishing has been reduced around 30% to 50%. Different types of fish were available at different levels of water. But now hardly remains in the river. Post rains, all water flows down the river leaving no water space for fish to flourish. Mahanadi River is no more considered as a source of livelihood and source of fish for lakhs of people like Basudev in Odisha.

No Water No Crop

≈≈ Shyam Sundar Patra is a small farmer aged about 58 years from Kulakaijangha village in Birdi block of Jagatsinghpur district. The village is on the river bank of Devi which connects to river Kathajodi at Cuttack. Kathajodi is the right branch of Mahanadi. He has a family of 6 members and the entire family depends upon agriculture. The total agriculture land is around 5 acres and he grows paddy, pulses and oil seeds in that land. His cultivation depends on Mahanadi water flow.

Water flow of Mahanadi has acutely decreased over a period of time. As a result the connecting rivers of the locality are affected, in most cases it has dried up. "We have not seen flood in Mahanadi for the last four years. Earlier there was flood in Mahanadi and this was quite beneficial for all of us, despite of very small amount of damage to agricultural crops. We were growing flood resilient crops in close proximity of the river basis and this crop was not badly affected due to flood. But flood left behind fertile top soil rich in minerals, new sand and new fishes. Soil got lighter and there is increased productivity of paddy cultivation done in the winter season" says, Shyam Sundar.

Agriculture Affected

≈≈ Premsila Kumura, is 75 years old lady, a resident of Khunti village, Bateimura panchayat, of Maneswar block, Sambalpur. She is a farmer living with her family including Bijay Kumura (husband) and Kailash (Son) Sabita (Daughter in law) and grand-daughters Haripriya and Jharana. She belongs to Gond community (Adivasi).

At the age of 14 she got married and came to this village. Before construction of Hirakud dam she lived here and was engaged in farming along with her husband. She narrates "We practiced traditional farming and used moss of canal for agriculture". She was also cultivating sugar cane with her husband. Gradually these practices disappeared. Earlier

she used counterpoise lifting for farming. Due to decrease of water level these days they are forced to use water pump. The imbalance of water flow in the river destroyed the moss in the canal. Before 9-10 years there were no such problems. But gradually it is visible and has bad impact on their livelihood. Last year the upper side agriculture field faced drought. Earlier people were doing multiple crops in a year but presently people prefer single crop farming, because of insufficient water.

She was cultivating many vegetables near the canal area along with her husband such as cucumbers, beans and other vegetables but due to industrial ash and chemical, they could not get sufficient harvest. She thinks that construction of barrages in the upper side disturbed the natural water flow and resulted in the decrease of water level. Pramila says "people were using canal water for drinking and catch fishes, as well as for domestic purposes but now a days it all seems like a dream". The sugarcane farming is also not happening in the village due to water scarcity in summer season, people are going to nearby villages/Sambalpur in search of work as daily wage labour. She is afraid of the water scarcity in future as more barrages are and will be constructed on the upper side of river in Chattigarh.

Water Tanker is the alternative to river water for River bank villages

≈≈ Saraswati Juguria is about 45 years old, living in Ginrapada, Badbazar,Sambalpur since 1972. She is a homemaker and has her husband Yuvraj Juguria and one son Sushanta Juguria. The village Ginrapada is close to the river bank, just 200 meters away from river Mahanadi,

She used to fetch water from Mahanadi for all her daily chores like washing, bathing and cleaning. But now the situation has changed. She desperately waits for water tank (by municipality) to collect water. There is no fixed time for arrival of the tank, if by any chance she misses the tank then there is no possibility of getting any water for the day. People jostle each other to collect water from tank instead of going to river Every day many disputes arise in her area during collection of water from water tank.

Before 10 years there was no water scarcity in Mahanadi River, but now volume of water along with its flow has gradually reduced since 2005-2007.

In her neighbourhood seven families were engaged in fishing but these days they left fishing activities and struggling for livelihood. The water flow is decreasing and also fishes are vanishing from the river. She said that due to utilization of water by industry (Bhusan Steel Plant) the water issues are increasing day by day. Each time they meet government officials to apprise them about their problems they do not get any positive responses. People like Saraswati who had plenty of water available in front of them few years before, are now fighting with others for a bucket around water tank every day.

She feels that if water scarcity is happening now a days what would happen when barrage will be constructed in upper side of the river by Chhattisgarh then huge problem will arise. Government should think about us and also should not give permission to any industry to use Mahanadi water.

Life long Struggle for livelihood with Mahanadi water

≈≈ Raghumani Dansana is a 72 years old man, resident of Sonutikra, near Hirakud Dam, Talab Panchayat of Dhankauda block, Sambalpur. He was a fisher man. He is living with his wife Daalimba Dansana, one son named Laxminarayan Dansana, and Padmini Dansana his daughter in law.

There are 150 households in his village and all are involved in fishing since 1956 after the Hirakud dam submerged their agriculture land and village forest which was the source to get various uncultivated forest produces like Char, Mahua, Tendu, Honey and other forest

products. They received only 4-5 decimals of land for housing only along with small amount of money (Rupees 1500-2000) from government. Raghumani's family is one of those who are not only displaced but also lost their primary sources of incomes and had to switch to fishing. But the struggle doesn't end here; according to Raghumani the water flow and amount of water has reduced in the last 10-15 years which has decrease the amount and varieties of fishes and he and his family was forced to quit fishing too. Now his son has a small grocery shop and the whole family is dependent on it. Like Raghumani the situation of every household of the village is same – Fishing is no longer feasible and they are switching to other petty jobs and businesses or daily wage.

When he came to the new place called Sonutikra, that time his family was staying in temporary home constructed by government. At that time they were unable to access education and health facilities. His family faced many difficulties to cope in the new place and situation. During displacement they were forced to leave their primary occupation of sale puffed rice and also denied to accessing forest produces. Raghumani shared that "we came to know that Chhattisgarh Govt. is constructing dam and barrages at upper side. We fear that as we are already displaced and struggling for livelihood, this will again push us to difficulties of life. It will lead to water scarcity for farming, fishing and domestic use".

The Tihura village (from where the people displaced) was full of natural resources. Since 1956 his father started fishing and that time fishing was major livelihood sources. In 1963 Raghumani started his occupation in fishing. After some years people elected him as president of Mohammadpur Fisheries Society. The industries released chemical & acid to Mahanadi River and therefore lot of fish died. He took lead and complaint to Thermal Power Plant, Jharsuguda not to release industrial waste water to Mahanadi River. Unfortunately they did not receive positive responses and were ignored by industries. Since 2000-2003 he observed that fish collection and water flow decreased. Before that he personally measured the water level near dam area and found that water level was 147 fit in the year of 2000 but these days it decreased to 75 ft. He says decreasing water flow leads fish dying and also soil is filled in the river. If this type of situation prevails then one day river will die. Before 2000-2002, he had seen 40 types of fish but these days only 10 types of fish are visible. Earlier about 15 years back, each household were getting 60 to 70 Kg. of fish per month and now it has reduced drastically. During the month of April to September of the year a large varieties of fish like rui, bhakur, mirkila, kajuri, singhali, kau, bainra, tengni, khapsi, saul were found available but over the period this diversity of fish in the river Mahanadi has come down insignificantly.

He suggested that, if we do not give permission to use water of Mahanadi river by industries then all these issues that communities are facing will reduce.

Hope for getting rights

≈≈ Sukanti Pande is a 54 years old female, residing at Mohammadpur village, Hirakud NAC, Sambalpur. She is a homemaker and engaged in fish catching. She lives with her husband Hariar Pande. They have two sons named Manoj Pande and Rajesh Pande. They belong to adivasi, the Gond community.

Her family was displaced during Hirakud dam construction and she came to know from her parents that they faced lots of difficulties during resettlement in new place. They received only small compensation from government at that time. All facilities were easily accessible in previous village but after displacement they did not get any support or facilities. She got married when she was 15-16 year old and stayed at her in-laws house. As they had lacked livelihood opportunity in her in-laws village, they shifted to Mohammadpur

village for fishing which is their traditional livelihood. Their struggle does not end here but gradually their situation became more vulnerable. They took membership in Mohammadpur MashyaJibi Society and started their livelihood. Every year they were financially exploited by the Secretary, Mohammadpur MashyaJibi Society.

Gradually fish collection decreased, especially during 2001-2003 and due to polluted water many fishes died. Last year the fishery department banned fish collection from the month of June to August and the department said the same action will be taken for the coming years as well. During this period they struggled for livelihood and got themselves engaged in daily wage works. According to Sukanti, industries release chemical into the river water resulting in death of fishes. During fish collection she observed that fishes were already found dead and those are caught found peculiarly soft. The water level also decreased as compared to 5-7 year ago. Canal water is also ceased to flow during the months of May, June & July which ultimately increase their difficulties. There is no separate bathing space for females in canal and people from different villages share the same bathing place. The industries are getting regular water for their industrial work, but the villagers around the villages of these industries are deprived from it. The villagers especially suffer a lot during summer days due to lack of government facilities and were forced to use water with iron contents from tube wells.

She said that people should be given rights/access to water & river and at the same time government should take necessary action to reduce water pollution caused by these industries & priority should be given towards the life of people & not to industries.

Years Passed- Still waiting for peaceful and healthy life

≈≈ Urkula Padhan is a 70 years old lady, residing at Mohammadpur village, Hirakud NAC, Sambalpur. She is a homemaker. She is living with her two sons Chaturbhuja Padhan and Kailash Padhan.

She was displaced during Hirakud Dam construction and shifted to Jhankarpali village (Maneswar block). As they could not cope up with new place, stayed there only for 6-7 years and shifted to her uncle's home at Taalab village (Dhankauda block). There after she got married and lived in Tabadabahal village with her husband. Her in-laws also were displaced from Hirakud Dam and struggled for livelihood. As they have no agricultural lands and lack of livelihood sources, they decided to live near Hirakud Dam and manage their livelihood. In 1970-72 many land were available near Hirakud Dam and water sources were available as per the requirement. As many people displaced and could not cope with the new places, they decided to move to nearby villages of Hirakud Dam and lived there. The surrounding place always reminded them about their original village where she had enjoyed her life with dignity and had access to water from her village, also they were harvesting lots of paddy. After displacement she felt her childhood life as a beautiful dream. They received only paltry amount from the government as resettlement.

These days water is decreasing from the river as compared to 6-7 years ago. Industries are increasing and use of Mahanadi water and also they are releasing their polluted water to the river. Therefore water is getting polluted rapidly and harming the farming. Many times ashes are released in air by the industries and directly impact the agricultural land. Due to problem of drinking water, quarrels happen among people most of the days. From May to July month people feel the water scarcity and government is also not providing any alternative facilities for drinking water. She heard about the construction of barrages by Chhattisgarh government. She says that existing situation is so vulnerable that when

the barrages will be constructed by Chhatishgarh government on upper side of river then it would impact our life drastically. Odisha government distributes water to industries and we are facing 3 months water scarcity every year. Consequently people will die fighting for water in near future. She thinks the struggle for a drop of water will never end in her life. She suggested that the government should think for the betterment of common people and if barrages will be constructed then it should not be for industries but for farmers. Natural water flow should not be broken otherwise the environment will be imbalanced.

More Water less available

≈≈ Parsuram Munda aged 84 years, resident of Bhoipali village of Maneswar block, Sambalpur Municipality, Odisha. He is a farmer and lives with his daughter Sabita Munda and son in law Bhagwana Munda. Sabita has three sons named Sikandar, Mukandar and Jitendar. They are a family of 6 members. He is getting a pension of Rs. 300 every month under old-age pension. Due to incorrect age in voter ID, he is getting 300 instead of 500 rupees.

While he was 14 years old, during that time the canal was constructed for water supply from Hirakud dam. The canal is a branch of Sason canal. He narrates "the water flow was adequate for farming and hygienic for drinking water. Around 10 years ago the water flow was continuous and normal but these days canal water has stopped randomly likes 2-3 days in week without any information. Starting from May till mid- June there is no supply of water from Hirakud Dam".

During the rainy season, the industrial ash flows into the canal and makes water unhygienic and polluted. Parsuram says "before 6 years people from Arnapurna paani panchayat (Local collective) made campaign and went to Hirakud dam for protesting against industries. They raised voices on not supplying Mahanadi water to any industries. During that time many people were beaten by police officers but did not receive any positive responses".

He assumes that due to increase of barrages, industrialization and privatisation of water (use of water by industry) there is low water flow from upstream. These days not only the water flow in canal have reduced but chemical water from industries are making water more hazardous for health. Many times surrounding land around the canal are damaged due to ash from industries. During his younger days, he was collecting fishes in rainy season but gradually it reduced and many fishes are dying due to release of industrial ash to the canal. During summer season canal water is stopped and with few functioning tube wells, people face lots of difficulties. With passing time the level of ground water has decreased significantly.

He suggested that no industrial ash should be released to the river and permission should not be given to construct barrages on upstream of the Mahanadi.

CHAPTER - V

Conclusion and Recommendation

The Mahanadi River is witnessing several changes during the last two decades especially after the formation of the new state of Chhattisgarh. The Mahanadi River is considered the lifeline of Chhattisgarh and the riparian state Odisha with equal importance on its waters for its own development. The river itself is undergoing changes in the precipitation in its catchment and the water resources and their utilization resulting from human interventions and climatic changes.

The recent developments in surface water resources are a point of contention among the two riparian states. There are a number of interventions coming up in the sub-basins in Chhattisgarh. These include several barrages (Samoda, Sheorinarayan, Basantpur, Mironi, Saradih, Kalma, Kudari and Chichpol), minor dams/anicuts/ diversion projects (Amamuda, Salka, Lachhanpur, Khongsara on Arpa and Kudurmal on Hasdeo), two major projects Kelo and Arpa-Bhaisajhar, besides the Pairy-Mahanadi Intra State Link Project and the Tandula Reservoir Augmentation Scheme on Mahanadi River Project. They are mainly to provide water for industries.

It has been observed that the average annual runoff over last few years has been decreased. Community apprehended that this is happening due to the increased usage and diversion of water on the upstream and less rainfall in past year's. Post construction of barrages has seen decrease in the monsoon flows. People reveal that over the period of 10 years there has been a drastic reduction in the runoff and corresponding discharge rate. It has severe impact on water resources and livelihoods. There should be more systematic release from barrages to maintain ecological flow to help the water resource/flow as well as livelihood promotion. However, the overall impact on the flow and especially the need for monsoon flow for aquatic habitat and livelihoods is being compromised in the process of alteration.

The river below Hirakud Dam does not flow at all. The biggest impact it has created is on the migration of fish due to which fish population in the river is decreasing, thus impacting the livelihoods of the fishermen. It has also impacted the river bed cultivation which was practiced by landless and marginal farmers since long. Fishermen in and around Mahanadi, narrate stories of low yield, poor quality of fish as well as the long hours spent in catching fish after commencement of barrages. According to them they used to fish in the river to catch 25- 30 kg of fish every day which now even in a good season has fallen to only 1 to 2 kg of fish now. Besides low flow affecting the fish population, industries are releasing their effluents without treatment and use of pesticide and explosion to catch fish further affecting their habitat.

The sediment flows and frequency of the floods have also reduced in the Mahanadi River. This has impacted the livelihoods of farmers who used to do farming on riverbed and flood plains. Such farming is an important source of income for the landless people. They use fertile land on the banks and the beds when flood water of the river recede after each monsoon. Cultivation is carried out from October to January. Crops

grown are mostly vegetables like cabbage, cauliflower, onion, tomato, cucumber, gourd, bitter gourd, brinjal and ladies finger. The farmers said that during the monsoon, the banks and flood plains would remain submerged for some days which help in sediment deposition. The low flows have reduced the cultivable area while increasing the application of groundwater and fertilizers which they otherwise never used.

Mining, increasing industrialisation and growing urban population is changing the land and water scenario of the basin and adding to the problems of pollution as observed in most part of Odisha. Apart from discharging effluents into the river, the massive use of fertilizer and urban discharge is causing pollution in River. Fishermen experienced the impact of pollution where the fish they catch immediately died and began to rot. People observed that the effluents released by industries used to turn the water completely black making it unfit for consumption, fishing and even other daily activities like bathing, washing clothes and bathing cattle. The River is increasingly becoming polluted at many spots depending upon the concentration of mines, industries and habitations. If preventive measures are not put in place, the river will be under stress in the near future.

The conflicting situation between Mahanadi Basin States like Odisha and Chhattisgarh may result in irreparable damage to community economy, life, property and social fabric in the basin in both states. Culturally, historically and ecologically both basin states are inseparable. The river Mahanadi has been the common natural, social, cultural and economic heritage that the people of both the states share. All possible options for a peaceful resolution of the conflict required to be promoted through an inclusive process.

The decisions regarding river basins and river water sharing should take people of the basin area on board through inclusive processes. Farmers, fishermen, boatmen and other users of water like the urban local bodies, industries, government departments etc.

A river basin is an ecological entity that naturally connects the inter-dependent natural and human resources in its geography. This calls for the basin's governance and management as one unit for ensuring sustainable development. River basin organisations with intended spirits of real stakeholder inclusion could take decisions regarding the rivers.

It is time to allow River Mahanadi to continue to flow. Exploitation of the river beyond its carrying capacity might lead to ecological devastation and destruction of the basin as an extreme case. Dams and barrages should be the last resort, after due diligence to Environmental and social impact assessment and a time bound impact mitigation efforts.

Need to utilize minimum water of the river and allow the river to use maximum for its ecological function. In other way it needs to protect the right of river and rights to river simultaneously. A comprehensive water policy to ensure river right and people's rights over water needs to be formulated. There is a need to provide drinking water for all, avail water for Irrigation, making water available for domestic and wildlife, village Industries.

A details conservation plan for all water sources and flows in river, rivulets, springs need to be prepared and also need to stop commercialization and commoditization of water.

The myth of 'water going to the sea is a waste' - should be strongly countered with. The excess water going to the sea is a natural process and

through this it performs very important ecological functions like building up the coast with sand and silt, controlling salinity-ingression, recharging the ground water in the flood plain, maintaining the bio-diversity and growth of mangroves, sustaining coastal livelihoods and culture.

Not only the quantity, but also the quality of the river water should be focussed on. It should be ensured that water in all the stretches of the river is potable. The urban bodies and the industries should treat their waste water before releasing to the river. There should be citizen's monitoring of water quality and waste water treatment by urban bodies and industries. There is also an urgent need to bring a halt on industrial activities especially polluting and environmental disastrous thermal power plants and other industries that require more water. Government of both the states should declare moratorium on river polluting industries.

Allocation of water to different sectors should be done as per the priorities based on life and livelihood requirement.

An inclusive process should be initiated to work on a river policy for the state of Odisha with informed stake holders' dialogues. Integrated and inclusive river basin management is the current requirement.

Reference

Central Pollution Control Board (2014-15), River stretches for restoration of water quality

Central Water Commission (2009), Integrated hydrological data book

Central Water Commission (2012), Integrated hydrological data book

CWC (2012), Reassessment of water resource availability in India using space inputs, CWC, 2017

Devananda Beura (2015). Floods in Mahanadi River, Odisha, India: Its Causes and Management

Forum for Policy Dialogue on Water Conflict (2017), Mahanadi river basin – A situation analysis (Referred to here as 'Forum, 2017')

Forum for Policy Dialogue on Water Conflict (2017), Water allocations and use in the Mahanadi river basin - A Study of the Agricultural and Industrial Sectors (Referred to here as 'Forum, 2017')

Government of Odisha (1947), The Mahanadi Valley Development Hirakud Dam Project Report, Volume 1

Hingane, L.S.Et al (1985), Long-term Trends of Surface Air Temperature in India," Journal oJClimatolog}: Vol. 5, 1985, pp. 521-528

India-WRIS (2018), Ministry of Water Resources, Government of India (Accessed at: http://www.india-wris.nrsc.gov.in/wrpinfo/index.php?title=Mahanadi on June 18, 2018)

Kar Et al (2010), Development of flood forecasting system using statistical and ANN techniques in the downstream catchment of Mahanadi basin, India; Journal of water resource protection, Volume 2, No. 10

Lilhare and Mishra (2014), Climate Change Impacts on Water Resources in Mahanadi River basin (India), American Geophysical Union

P Govind Rao (1993), Climatic changes and trends over a major river basin in India, Climate research Vol. 2: 215-223, 1993

P Govind Rao (2009), Effect of Climate Change on Stream flows in the Mahanadi River Basin, India

Sengupta Et al (2018), Flood Forecasting and Inundation Mapping in the Mahanadi River Basin: A Collaborative Effort between India and the United States.

actionaid

www.actionaid.org/india

actionaidindia

ActionAid Association
R-7, Hauz Khas Enclave
New Delhi - 110016
Phone : 91-11-4064 0500